III. OVERVIEW OF TECHNOLOGY TRANSFER AND THE DOD

Technology transfer is the exchange of technology between the public and private sectors, between the Federal agencies and academia, or any combination thereof. Technology transfer includes[11] spin-off, dual-use, and spin-on activities that allow DoD programs to make the best possible use of national scientific and technical capabilities as well as provide technologies for non-defense applications. Technology transfer is also envisioned to incorporate innovative technology into military systems as well as to meet mission needs at a lower acquisition cost by taking advantage of the economies of scale by purchasing from a larger industrial base.

Policy guidance for DoD Domestic Technology Transfer and Dual-Use Technology Development (DTT/DUTD) initiatives was introduced in a June 1995 Secretary of Defense memorandum. The memorandum lays out the formal DoD policy on DTT/DUTD issues. "DoD Domestic Technology Transfer/Dual Use Technology Development (DTT/DUTD) are integral elements of the Department's pursuit of its national security mission. They must have a priority role in all DoD acquisition programs and must be recognized as key activities of the DoD Labs."[12] For laboratories, the memo states: "All DoD labs, as defined by 15 U.S.C. ss3710a(d)2, and other organizations responsible for RDT&E activities must make DTT/DUTD a priority element in the accomplishment of their science and technology programs." This policy was further instituted within DoD via Directive 5535.3 and Instruction 5535.8, discussed later in this section.

The DoD Technology Transfer Program ensures that its research and development endeavors enhance the effectiveness of DoD forces and systems. The Program promotes domestic technology transfer through U.S. and foreign patenting, patent licensing, and protecting other intellectual property rights. The DoD Directive on Domestic Technology Transfer states that DoD inventions applicable for licensing shall be publicized to accelerate transfer of technology to the domestic economy. The DoD Instruction states that patents are one of the original instruments of technology transfer and represent one of the clearest means to characterize an innovation and to describe how it may be of benefit to the user.

Licensing is the classic method of transferring technology from labs and universities to the private sector and is a means of conveying access to intellectual property. In the past, the licensing of federally funded inventions was required to be nonexclusive. Since significant investments are required to bring these inventions to market, federal technologies were of little interest to the private sector without the protection of an exclusive license. However, since the passage of the series of technology transfer legislation of the past decade, federal technologies have been more frequently licensed on an exclusive basis. Such exclusive licensing is desired in cases where the licensee needs to invest considerable additional R&D funds to bring the technology to market. A recent GAO report[13] noted that in the period from 1996 to 1998 exclusive licenses accounted for approximately 45 percent of total DoD licenses.

Before 1986 patenting of DoD inventions was limited. Once authority to license was granted to DoD, licensing has gone from royalty-free nonexclusive licenses to earning royalties on nonexclusive and exclusive licenses. Today, a DoD license can be as sophisticated as any commercial license.

Technology Transfer Legislation Related to Patenting and Licensing

The Stevenson-Wydler Technology Innovation Act of 1980 is one of the cornerstones of technology transfer. Although there are several pieces of legislation that pertain to issues related to technology transfer, only those related to patenting and patent licensing will be mentioned as background for this study. The table below shows legislation and executive order specific to patenting and patent licensing.

Legislation and Executive Order Specific to Patents and Patent Licensing

- Stevenson-Wylder Technology Innovation Act of 1980 (PL 96-480)
- Bayh-Dole Act of 1980 (PL 96-517)
- Federal Technology Transfer Act of 1986 (PL 99-502)
- Omnibus Trade and Competitiveness Act of 1988 (PL 100-418)
- Executive Order 12591, The Facilitating Access to Science and Technology
- National Technology and Advancement Act of 1995 (Morella Act) (PL 104-113)
- Technology Transfer Commercialization Act of 2000 (PL 106-104)

Stevenson-Wydler Technology Innovation Act of 1980[14] directed the Secretary of Commerce to improve the economic, environmental, and social well-being of the United States by promoting technological development. The Act appointed an office within the Department of Commerce (DoC) to serve as a clearinghouse for federally-owned or originated technical information with potential application in state or local government or private industry. This Act also established the ORTAs at each Federal agency to coordinate and assist with transferring federal technologies, products, and services to the private sector.

With respect to patents and licensing, the Act permitted the Federal agency director of any of its Government-operated Federal laboratories to negotiate license agreements for inventions made or other intellectual property developed at the laboratory and other inventions or other intellectual property that may be voluntarily assigned to the Government.

The Act also permitted a Government-operated Federal laboratory to:[15]

- accept, retain, and use funds, personnel, services, and property from collaborating parties and provide personnel, services, and property to collaborating parties;
- grant or agree to grant in advance, to a collaborating party, patent licenses or assignments, or options thereto, in any invention made in whole or in part by a laboratory employee under the agreement, retaining a nonexclusive, nontransferable, irrevocable, paid-up license to practice the invention or have the invention practiced throughout the world by or on behalf of the Government and such other rights as the Federal laboratory deems appropriate;
- waive, subject to reservation by the Government of a nonexclusive, irrevocable, paid-up license to practice the invention or have the invention practiced throughout the world by or on behalf of the Government, in advance, in whole or in part, any right of ownership which the Federal Government may have to any subject invention made under the agreement by a collaborating party or employee of a collaborating party; determine rights in other intellectual property developed under an agreement; and

- to the extent consistent with any applicable agency requirements and standards of conduct, permit employees or former employees of the laboratory to participate in efforts to commercialize inventions they made while in the service of the United States.

The Act also states that any royalties or other income received by a Federal agency from the licensing or assignment of inventions under agreements entered into by Government-operated Federal laboratories shall be retained by the agency whose laboratory produced the invention and shall be disposed of as follows:[16]

- The head of the agency or his designee shall pay at least 15 percent of the royalties or other income the agency receives on account of any invention to the inventor (or co-inventors) if the inventor (or each such co-inventor) has assigned his or her rights in the invention to the United States. [Note: DoD policy assigns 20% of the royalties to the inventor or co-inventors.]
- An agency may promulgate regulations providing for an alternative program for sharing royalties with inventors. Such regulations must:
    - ♦ guarantee a fixed minimum payment to each such inventor, each year that the agency receives royalties from that inventor's invention;
    - ♦ provide a percentage royalty share to each such inventor, each year that the agency receives royalties from that inventor's invention in excess of a threshold amount;
    - ♦ provide that total payments to all such inventors shall exceed 15 percent of total agency royalties in any given fiscal year; and
    - ♦ provide appropriate incentives from royalties for those laboratory employees who contribute substantially to the technical development of a licensed invention between the time of the filing of the patent application and the licensing of the invention.

The balance of the royalties or other income shall be transferred by the agency to its Government-operated laboratories, with the majority share of the royalties or other income from any invention going to the laboratory where the invention occurred. In addition, the funds so transferred to any such laboratory may be used or obligated by that laboratory during the fiscal year in which they are received or during the succeeding fiscal year for:[17]

- payment of expenses incidental to the administration and licensing of inventions by that laboratory or by the agency with respect to inventions which occurred at that laboratory, including the fees or other costs for the services of other agencies, persons, or organizations for invention management and licensing services;
- reward of scientific, engineering, and technical employees of that laboratory, including payments to inventors and developers of sensitive or classified technology, regardless of whether the technology has commercial applications;
- further promotion of scientific exchange among the Government-operated laboratories of the agency; or
- education and training of employees consistent with the research and development mission and objectives of the agency, and for other activities that increase the licensing potential for transfer of the technology of the laboratories of the agency.

Any of such funds not so used or obligated by the end of the fiscal year succeeding the fiscal year in which they are received shall be paid into the Treasury of the United States. Any payment made to an inventor as such shall continue after the inventor leaves the laboratory or agency. Payments made under this section shall not exceed $100,000 per year to any one person,

unless the President approves a larger award.[18] [Note: This value has been raised to $150K by NTTA of 1995.]

If a Federal agency which has the right of ownership to an invention under this Act and does not intend to file for a patent application or otherwise to promote commercialization of such invention, the agency shall allow the inventor, if the inventor is a Government employee or former employee who made the invention during the course of employment with the Government, to retain title to the invention (subject to reservation by the Government of a nonexclusive, nontransferable, irrevocable, paid-up license to practice the invention or have the invention practiced throughout the world by or on behalf of the Government). In addition, the agency may condition the inventor's right to title on the timely filing of a patent application in cases when the Government determines that it has or may have a need to practice the invention.[16]

Bayh-Dole Act of 1980[20] (1980 Patents and Trademark Amendments Act/University and Small Business Patent procedure Act) gave universities, not-for-profit organizations, and small businesses the right to obtain title to inventions developed with Government funding.

Federal Technology Transfer Act (FTTA) of 1986[21] amended the Stevenson-Wydler Technology Innovation Act of 1980 to authorize Federal agencies, subject to specified conditions, to permit the directors of their Government-operated Federal laboratories to enter into CRADAs with other Federal agencies, State or local governments, industrial organizations, industrial development organizations, public and private foundations, nonprofit organizations including universities, licensees of federal invention, and other persons. In addition, the Act allows for the negotiation of patent license agreements.

The FTTA authorized Federal laboratories, under CRADAs to: (1) accept, retain and use funds, services, personnel, and property from collaborating parties and provide services and property to collaborating parties; (2) grant patent licenses or assignments, or options, in any subject invention made by a Federal employee, or made jointly by a Federal employee and an employee of the collaborating party, and to retain such rights as the laboratory deems appropriate; (3) waive any right of ownership which the Federal Government may have to any subject invention made by a collaborating party or such party's employee under the agreement; and (4) to the extent consistent with applicable agency requirements, permit employees or former employees of the laboratory to participate in efforts to commercialize inventions they made while in the service of the United States.

The FTTA also set forth rules and formulas for the distribution of royalties or other income received by Federal agencies from the licensing or assignment of inventions under CRADAs and from inventions of Federal laboratories licensed under provisions of federal law relating to domestic and foreign protection of federally owned inventions. Specifically the FTTA permits royalty income from patent licensing and assignment to be distributed directly to the inventor(s) and to the producing laboratory. At least 15% of the royalties must be paid to the inventor(s) with the balance of the royalties going to the laboratory to be used for additional awards, incidental expenses, or further scientific exchange or education/training consistent with the mission. [Note: DoD policy assigns 20% of royalties to the inventor or co-inventors.]

The Act also authorized Federal agencies to transfer rights of ownership to an invention to the employee inventor, subject to specified conditions.

Omnibus Trade and Competitiveness Act of 1988[22] extended royalty payment requirements to inventors at the laboratories who are not Government employees.

Executive Order 12591: Facilitating Access to Science and Technology[23] encouraged the facilitation of CRADAs with other Federal laboratories, state and local governments, universities, and the private sector to assist in the transfer of technology to the marketplace including granting title to the rights of federally funded R&D to all contractors in exchange for royalty-free use by, or on behalf of, the Federal Government.

The National Technology and Advancement Act of 1995[24] (Morella Act) revised provisions regarding title to intellectual property arising from CRADAs. Under the Morella Act, a laboratory may grant, or agree to grant in advance, to a collaborating party, patent licenses, assignments, or options in any invention made in whole or in part by a laboratory employee under the agreement, for reasonable compensation when appropriate. Under the CRADA, the laboratory will assure that the collaborating party has the option to choose an exclusive license for a pre-negotiated field of use for any such invention under the agreement or, if there is more than one collaborating party, that the collaborating parties are offered the option to hold licensing rights that collectively encompass the rights that would be held under such an exclusive license by one party. In addition, the collaborating party may retain title to any invention made solely by its employee in exchange for normally granting the Government a nonexclusive, nontransferable, irrevocable, paid-up license to practice the invention or have the invention practiced throughout the world by or on behalf of the Government for research or other Government purposes.

With regard to income distribution from intellectual property received by Federal laboratories, the Morella Act provides for: 1) agency payments of $2,000 plus 15 percent of future royalties to the inventor, and payments to other contributing personnel; and 2) laboratory use of royalties for related research and other expenses.

The Act also provides that if the Government chooses not to pursue the rights of an invention of a Federal employee or former employee, such individual may obtain the right of ownership or otherwise promote the invention's commercialization.

Technology Transfer Commercialization Act of 2000[25] improves the ability of Federal agencies to license federally owned inventions. Under the Act, a Federal agency can grant an exclusive or partially exclusive license on a federally owned invention only if:

- granting the license is a reasonable and necessary incentive to obtain the investment capital and expenditure needed to bring the invention to practical application or otherwise promote the invention's utilization by the public;
- the Federal agency finds that the public will be served by granting the license, as indicated by the applicant's intentions, plans, and ability to bring the invention to practical application and that the proposed scope of the exclusivity is not greater than reasonably necessary to provide the incentive for bringing the invention to practical utilization;
- the applicant makes a commitment to achieve practical utilization within a reasonable time;
- granting the license will not tend to substantially lessen competition or create or maintain a violation of the antitrust laws; and
- in the case of an invention covered by a foreign patent or application, the interests of the United States industry in foreign commerce will be enhanced.

The Act provides for public notification in an appropriate manner for at least 15 days before a license is granted. In addition, the Act requires periodic reporting on the use of the invention by the licensee only to the extent necessary to enable the Federal agency to determine whether the licensee is complying with license terms.

The Role of Patents and PLAs in DoD Technology Transfer

DoD issued Directive and Instruction on Domestic Technology Transfer in 1999. Highlights from these policy documents relative to patenting and licensing are presented below.

DoD Directive 5535.3: DoD Domestic Technology Transfer (T2) Program[26] promotes domestic technology transfer through U.S. and foreign patenting, patent licensing, and protecting other intellectual property rights. The Directive states that DoD inventions applicable for licensing shall be publicized to accelerate transfer of technology to the domestic economy.

The Secretaries of the Military Departments and the Heads of the other DoD Components, including the Directors of the Defense Agencies, under the Office of the Secretary of Defense (OSD) Principal Staff Assistants, shall:

- Institute policies for protecting inventions and other intellectual property arising from federally supported R&D including policies for patenting inventions, licensing the patented inventions, and maintaining the patents with commercial potential. Costs and expenses to acquire and maintain those patents shall be funded by the DoD Components and shall not preclude collaborating parties from paying costs and expenses associated with protecting intellectual property rights.

- Institute policies under which laboratories may be authorized to license, assign, or waive rights to intellectual property and distribute royalties and other payments, in accordance with DoD Instruction 5535.8.

DoD Instruction 5535.8: Department of Defense Technology Transfer (T2) Program[27] ensures that the DoD technology transfer programs make the best possible use of national scientific and technical capabilities to enhance the effectiveness of DoD forces and systems. The Instruction states that patents are one of the original instruments of technology transfer and represent one of the clearest means to characterize an innovation and to describe how it may be of benefit to the user. The Instruction outlines procedures for protecting intellectual property to include the following:

- Evaluation of inventions arising from R&D efforts;
- Filing and prosecuting patent applications for those inventions selected as having sufficient benefit to justify obtaining patent protection;
- Determination of which patents shall remain enforceable through payment of required maintenance fees; and
- Providing for payment of costs and expenses to acquire and maintain patents and other intellectual property from the program elements funds, overhead accounts, royalties or other payments, or other sources, as applicable, of the DoD Components. The Instruction does not preclude collaborating parties from paying costs and expenses associated with intellectual property rights.

The Instruction also provides the following guidance for the distribution of royalties and other payments received by the DoD Components.

- The DoD Component shall pay to the inventor or each co-inventor each year, at least $2,000 plus equal shares of at least 20 percent of the remainder of the royalties or other payments. In the absence of extrinsic evidence that co-inventors made unequal contributions to the invention, subject to review and approval by the concerned legal counsel for the DoD Component, it shall be presumed that the co-inventors made equal contributions to the invention and are entitled to equal shares of the 20 percent remainder of the royalties or other payments. If the royalties or other payments received in any given year are less than or equal to $2,000, or for co-inventors, less than or equal to $2,000 times the number of inventors, the entire amount is paid to the inventor, or for co-inventors, the entire amount is divided equally among the co-inventors. The inventor or co-inventors shall receive their prescribed share of any royalties or other payments, as received by the Government on an annualized basis.

- Royalties or other payments from inventions to any one person shall not exceed $150,000 for each year without Presidential approval.

- A DoD Component or subordinate laboratory, when authority is delegated, may provide applicable incentives from royalties or other payments, to laboratory employees who are not inventors or co-inventors of such inventions, but who substantially increase the technical value of such inventions. When the incentive is in the form of a monetary payment, such payments may be at any level subject to the authority of the DoD Component or activity that approved the payment, but such payments shall not exceed the limits established above. Payments may be on a one-time or annual basis, and they shall cease when the employee is no longer employed by that DoD Component.

- Inventors shall be entitled to royalties or other payments income, as discussed above regardless of the date of the invention.

- Assignment and use of royalties or other payments income shall be applied, in accordance with the following schedule:
  - Royalties or other payments shall be used by the end of the second fiscal year succeeding the fiscal year in which the royalties and other payments were received.
  - After assignment of royalties and other payments to inventors above, any remainder may be used for the following:
    - Payment of expenses incidental to administration and licensing of inventions and other intellectual property;
    - Other activities of the DoD Component that increase the licensing potential for transfer of DoD technology;
    - Scientific R&D consistent with the R&D mission and objectives of activities of the DoD Component;
    - Reward of scientific, engineering, and technical employees of activities of the DoD Component;
    - Promotion of scientific exchange among other activities in the DoD Component; and
    - Education and training of employees consistent with the R&D mission and objectives of the Department of Defense.

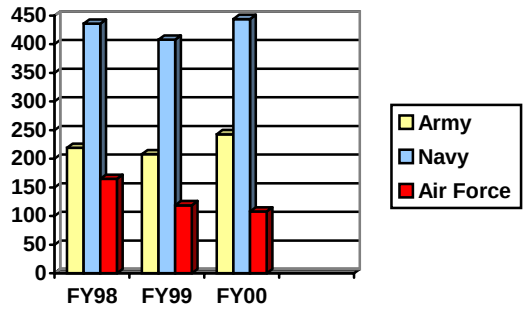
- Each DoD Component shall prescribe its own regulations as to whether inventors or co-inventors, whose whereabouts are unknown for 1 year, or more, are entitled to further royalty payments.

The Instruction deems the use of technology assessment as an important part of the technology transfer process and states that they shall be conducted to determine the potential commercial value of a laboratory and/or the intellectual property of a technical activity. The Instruction envisions the conducting of technology assessments as a continuous process in DoD laboratories and/or technical activities to enable development of a portfolio of marketable technologies that may be used to respond to inquiries and unanticipated application opportunities defined by potential clients.

Trends in Patenting and Patent Licensing in DoD

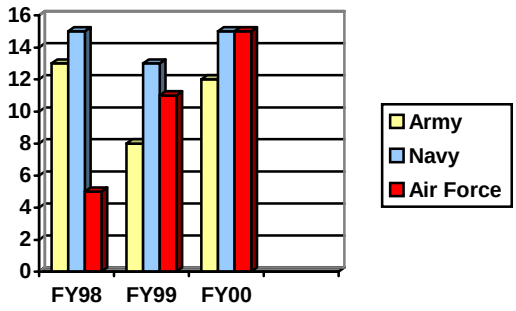
The question has been raised as to whether the American people and industry are getting a fair return on their R&D investment. One measure of this return on investment is the amount of royalty revenues from technology licensing received by American organizations. The lowest investment return in terms of royalty income lies with the U.S. Government, which invested over $60 billion in 1995 in R&D and received approximately $100 million in return. This low return on investment can be attributed in part on the types of research the Government funds. This research consists of militarily sensitive or basic research that is a long way away from commercialization and royalties. In addition, these research funds also support the development, testing and evaluation of systems, space exploration, and basic health care-related research.[28]

Number of Patents Filed
(Source: TT Service Managers and Offices of General Counsel)



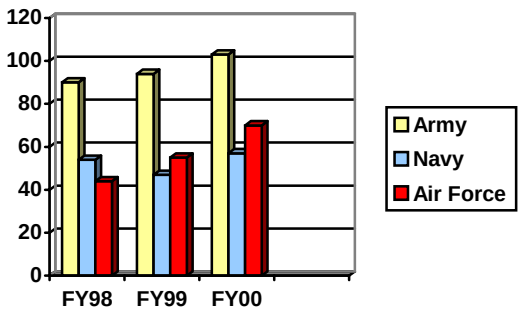
Service	FY98	FY99	FY00
Army	219	208	243
Navy	436	408	444
Air Force	165	119	108

New Patent License Agreements
(Source: TT Service Managers and Offices of General Counsel)



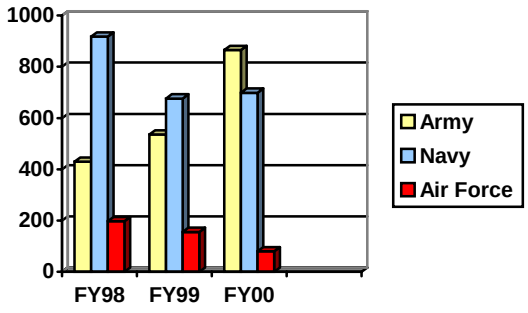
Service	FY98	FY99	FY00
Army	13	8	12
Navy	15	13	15
Air Force	5	11	15

Total Active Licenses
(Source: TT Service Managers and Offices of General Counsel)



Service	FY98	FY99	FY00
Army	90	94	103
Navy	54	47	57
Air Force	44	55	70

Total Royalty Income
(Source: TT Service Managers and Offices of General Counsel)



Service	FY98	FY99	FY00
Army	$429,600	$535,500	$865,900
Navy	$917,787	$676,555	$698,898
Air Force	$197,800	$156,000	$80,616

The number of patent filings for the Army has remained relatively stable over the three years shown. The Air Force shows a slight dip in patenting between FY99 and FY00 and the Navy shows a dip from FY98 to FY99. These dips can be attributed to normal fluctuations that can occur from year to year.

The number of total active licenses for the Army and Air Force has been steadily increasing for the three years shown. The dips in active license shown by the Navy is due to the expiration of a number of licenses in FY99. Total royalty income has been steadily increasing for the Army as would be expected from a steady increase in licensing. However, this increase in royalty income is mostly likely a result of licenses that have been in existence for the period of time necessary to have commercialized a product and therefore are generating revenue. The significant dip in total royalty income for the Air Force in FY00 is a result of the expiration of their largest producing license. This particular Air Force license generated approximately $120,000 in each of the years during the period from FY95 to FY99. The dip in the royalty income generated by the Navy between FY98 and FY99 is an anomaly in the data. The Navy had a peak in royalty income in FY94 and FY98. Therefore, aside from these two particular years, their trend in royalty income is upward.

One would expect that as patent filings increase, license agreements would increase, leading to an increase in royalty income. This trend appears to be holding true for the Army and Navy; however, the Air Force which is experiencing less patenting in recent years, is experiencing an increase in licensing activity. This trend may be due to more aggressive marketing efforts at the Air Force laboratories. Therefore, it is envisioned that with more aggressive patent marketing by the DoD laboratories, licensing could increase, leading to an increase in royalty income for the laboratories.

There are a number of "types" of PLAs that exist at the various DoD laboratories. Some are specific to the biomedical area. These versions of PLAs exist to make fine distinctions with regard to the rights a licensee has to Government inventions.

The ***Commercial Evaluation License*** grants nonexclusive rights to make and use technology for the purpose of evaluating its commercial potential. The license is granted for a limited number of months and does not grant the right to sell or otherwise distribute the invention.[29]

The ***Internal Commercial Use License*** grants the nonexclusive right to make and use the invention for the purpose of internal use by the licensee. These licenses do not grant the right to sell or otherwise distribute the invention, but allow the licensee to use the invention as a tool in their commercial development activities.[30]

The ***Nonexclusive and Exclusive Patent Licenses*** allow a company to commercialize the invention, under appropriate circumstances pursuant to applicable statutes and regulations. An exclusive license limits the use of the invention to a single group or entity while a nonexclusive license allows for use by multiple parties.[31]

The ***Biological Materials License*** allows a company to make, use, and/or sell commercially useful biological materials which are not in the public domain and for which patent protection cannot or will not be obtained. This type of license typically is nonexclusive and facilitates the commercial development of biological materials developed in government medical laboratories (specifically the Public Health Service (PHS) laboratories) without requiring that patent protection be obtained for every biological material.[32]

An ***Option Agreement*** is an agreement in which the grantee retains the right to perform or elect not to perform certain acts. This agreement is used to extend the term of election of a right to negotiate a license. The time period may be for any length, but typically is for six to 12 months. An option agreement can be used to allow the potential licensee time to evaluate the technology, assess the market potential, or perhaps obtain sources of funding.

A ***Government Use License*** authorizes, under the Bayh-Dole Act for all inventions made with federal funds, that the Government retains a nonexclusive, nontransferable, irrevocable, paid-up license to practice or have practiced for or on behalf of the United States any subject invention throughout the world. This type of license gives the Government the right to use any patented invention arising in the course of federally-sponsored research without the liability for patent infringement.[33]

Material Transfer Agreements, MTAs, are used when: 1) a party is providing material or information to a laboratory; 2) no collaboration beyond the transfer of the material or information is contemplated; 3) the laboratory is only to screen, test, or evaluate the material or information and provide a report of the results to the party providing the material; and 4) no funds, personnel, equipment, or other resources are provided to the laboratory. The screening, testing and evaluating of the other party's material or information could result in new intellectual property and subsequent patent applications owned by the U.S. Government or jointly owned by the interacting, but "noncollaborating" parties. Therefore, a service is not merely provided to the other party in a MTA but research is conducted relevant to the laboratory's mission with the supplied materials. Even though no formal collaboration is intended, the inventive process, working in its own way, may result in joint inventions.